

Note for 01/14/2021

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January 10, 2021

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1 Takeaway from the meeting

1. Parameter Change (i.e., μ , Σ , f)

- I can **change the diagonal elements**, (i.e., $\text{Var}(x_1)$), of covariance matrix, Σ
- The change of mean could **shift** the distribution to the left, right, up, and down
- A monotonic function can evenly scatter points or make the distribution skewed (**non-gaussian-looking data**)

2. Positive Semi-definite Matrix (PSD matrix)

- PSD matrix has only **non-negative eigenvalues**

Sylvester's Criterion: A Hermitian matrix (symmetric matrix), M , is positive-definite **if and only if** all of the leading **principal minors must be positive**. In other words, all the upper-left square matrices (1-by-1, 2-by-2, ..., and M) have a **positive determinant**.

- **Note: the product of $\text{eigen}(M) = \det(M)$**
 - If the determinant is negative, there is at least a pair of positive eigenvalue and negative eigenvalue.
- For example, the determinant of a **2x2** matrix is **ad-bc**, meaning that **the product of diagonal entries must be larger than the product of the off-diagonal**

- In order to find whether a matrix is PSD.
- (a) **Literal:** A matrix is PSD if and only if (i.e. is an equivalent definition essentially) if all the upper-left square matrices have a positive determinant

Formula:

$$p(X) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(\frac{-(x-\mu)^2}{2\sigma^2}\right).$$

Equations can also be written as

$$\mathcal{L} = \sum_{i=1}^n x_i \quad \text{and} \quad \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}. \quad (1)$$

We can also block certain things that we want to emphasize:

“Put a quote here” or a formula below:

$$\text{asdf} = 1 \quad (2)$$

$$\text{random text} = 2. \quad (3)$$

We can reference Section 1 and Subsection ??, or specific equations as (2) or (1). We can also cite papers such as ?, or we can cite with parenthesis (?). (When you want to cite papers yourself, you can use Google scholar, putting URLs like https://scholar.google.com/scholar?hl=en&as_sdt=0%2C39&q=Benchmark+and+parameter+sensitivity+analysis+of+scRNAseq+clustering+methods.&btnG=. Click on the quotation sign, and then “Bib-tex.”

2 Another example

Here are two things you can do – making an itemized list or an enumerated list

- Item 1
- Another item

Alternatively,

1. We can also make text red
2. **Bold some words** or *emphasized others*.

References

A Some figure

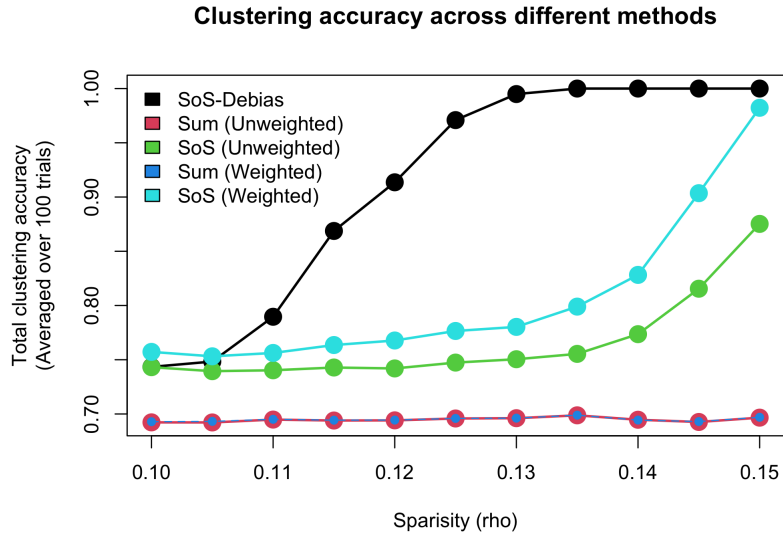


Figure 1: Total clustering accuracy (averaged over all 100 trials) across $\rho \in [0.1, 0.15]$.